

1. A method for guiding a medical instrument to a target site within a patient, comprising:

capturing at least one intraoperative image from the patient;

5 identifying a spatial feature indication of a patient target site on the intraoperative image,

determining coordinates of the patient target site spatial feature in a reference coordinate system,

determining a position of the instrument in the reference coordinate system,

10 creating a view field from a predetermined position, and optionally orientation, relative to the instrument in the reference coordinate system, and

projecting onto the view field an indicia of the spatial feature of the target site corresponding to the predetermined position, and optionally orientation.

2. The method of claim 1, further comprising

15 a. using an ultrasonic source to generate an ultrasonic image of the patient, and

b. determining coordinates of a spatial feature indicated on said image from the coordinates of the spatial feature on the image and the position, and optionally orientation, of the ultrasonic source.

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3. The method of claim 1, wherein said medical instrument is a source of video and the view field projected onto the display device is the image seen by the video source.

4. The method of claim 1, wherein the view field projected onto the display device is that seen from the tip-end position and orientation of the medical instrument having a defined field of view.

5 5. The method of claim 1, wherein the view field projected onto the display device seen from a position along the axis of instrument different from the target seen at a tip-end position of the medical instrument.

6. The method of claim 1, wherein the target site spatial feature indicated is a volume or
10 an area, and said indicia are arranged in a geometric pattern defining a boundary of the indicated spatial feature.

7. The method of claim 1, wherein the target site spatial feature indicated is a volume, an area or a point, and said indicia are arranged in a geometric pattern indicating a position
15 of a point within the target site.

8. The method of claim 1, wherein a spacing between or among indicia is indicative of the distance of the instrument from the target-site position.

20 9. The method of claim 1, wherein the size or shape of the individual indicia is indicative of the distance of the instrument from the target-site position.

10. The method of claim 1, wherein the size or shape of individual indicia is indicative of the orientation of said instrument.

11. The method of claim 1, wherein said indicating includes indicating on each image, a
5 second spatial feature which, together with the first-indicated spatial feature, defines a surgical trajectory on the displayed image.

12. The method of claim 1, which further includes using said instrument to indicate on a patient surface region, an entry point that defines, with said indicated spatial feature, a
10 surgical trajectory on the displayed image.

13. The method of claim 11 or 12, wherein the surgical trajectory on the displayed image is indicated by two sets of indicia, one set corresponding to the first-indicated spatial feature and the second set by the second spatial feature.
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14. The method of claim 11 or 12, wherein the surgical trajectory on the displayed image is indicated by a geometric object defined, at its end regions, by the first-indicated spatial feature and the second spatial feature or entry point indicated.

20 15. The method of claim 1, further comprising moving the instrument toward the target site by moving the instrument so that said indicia are placed or held in a given state in the displayed field of view.

16. A system designed to a user in guiding a medical instrument to a target site in a patient, comprising

(a) an imaging device for generating one or more intraoperative images with spatial

5 features of a patient target site in a 3-dimensional coordinate system;

(b) a tracking system for tracking the position and optionally, the orientation of the medical instrument and imaging device in a reference coordinate system,

(c) an indicator by which a user can indicate a spatial feature of a target site on the one or more images,

10 (d) an electronic computer operably connected to said tracking system, display device, and indicator, and

(e) computer-readable code which is operable, when used to control the operation of the computer, to carry out the steps of

(i) recording target-site spatial information indicated by the user on said image(s),
15 through the use of said indicator,

(ii) determining from the spatial feature of the target site indicated on said image(s), 3-D coordinates of the target-site spatial feature in a reference coordinate system,

(iii) tracking the position of the instrument in the reference coordinate system,

20 (iv) creating a view field as seen from a known position and, optionally, a known orientation, with respect to the tool, in the reference coordinate system, and

(v) projecting onto the view field, indicia whose states indicate the indicated spatial feature of the target site with respect to said known position and, optionally, said known orientation,

5 17. Machine readable code in a system designed to assist a user in guiding a medical instrument to a target site in a patient, said system including

(a) an imaging device for generating one or more intraoperative images, on which a patient target site can be defined in a 3-dimensional coordinate system,

10 (b) a tracking system for tracking the position and optionally, the orientation of the medical instrument and imaging device in a reference coordinate system,

(c) an indicator by which a user can indicate a spatial feature of a target site on such image(s),

15 (d) an electronic computer operably connected to said tracking system, display device, and indicator, said code being operable, when used to control the operation of said computer, to:

(i) record target-site spatial information indicated by the user on said image(s), through the use of said indicator,

20 (ii) determine from the spatial feature of the target site indicated on said image(s), 3-D coordinates of the target-site spatial feature in a reference coordinate system,

(iii) track the position of the instrument in the reference coordinate system,

(iv) create a view field as seen from a known position and, optionally, a known orientation, with respect to the tool, in the reference coordinate system, and

5 (v) project onto the view field, indicia whose states indicate the indicated spatial feature of the target site with respect to said known position and, optionally, said known orientation,

18. The code of claim 18, further comprising code to allow a user, by observing the states of said indicia, to guide the instrument toward the target site by moving the instrument so
10 that said indicia are placed or held in a given state in the displayed field of view.

19. The code of claim 18, wherein the target site spatial feature indicated is a volume or an area, and said indicia are arranged in a geometric pattern defining a boundary of the indicated spatial feature.

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